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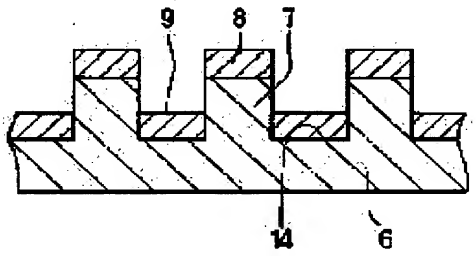
(54) MASTER INFORMATION CARRIER

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a master information carrier which can realize a preformat recording to cope with the need of the future surface recording density of 10 giga bit order.

SOLUTION: Recessed and projected shapes corresponding to a master information pattern are formed on the surface of a substrate 6 which is made of silicon or silcon oxide. Magnetic thin film 8 are formed on the surfaces of at least projected sections 7 among the recessed and projected shapes. The substrate 6 is made of silicon or silicon oxide. The recessed and projected shapes are processed by either a reactive ion etching method or a reactive plasma etching method and then, the film 8 are formed.



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CLAIMS

[Claim(s)]

[Claim 1] The master information carrier characterized by having formed the shape of toothing corresponding to an information signal in the front face of a base, and being the master information carrier of the shape of said toothing in which the magnetic thin film was formed on the surface of heights at least, and for said base having consisted of silicon or silicon oxide, and processing the shape of said toothing using a reactive-ion-etching method or the reactant plasma-etching method.

[Claim 2] The shape of toothing corresponding to an information signal is formed in the front face of a base, and it is the master information carrier of the shape of said toothing in which the magnetic thin film was formed on the surface of heights at least. The base material with which said base consists of one ingredient chosen from the group which consists of polymeric materials, a semiconductor material, a metallic material, and a ceramic ingredient, The master information carrier characterized by having consisted of the silicon layer or silicon oxide layer formed on said base material, and processing the shape of said toothing using a reactive-ion-etching method or the reactant plasma-etching method.

[Claim 3] The master information carrier according to claim 2 by which the interlayer has been stationed between a base material, a silicon layer, or a silicon oxide layer.

[Claim 4] The master information carrier according to claim 3 which an interlayer becomes from one ingredient chosen from the group which consists of aluminum, Cr, Ti, Ta, Mo, W, and aluminum 2O3.

[Claim 5] A master information carrier according to claim 1 or 2 with the larger level difference of the irregularity in the shape of toothing than the thickness of a magnetic thin film.

[Claim 6] The master information carrier according to claim 5 whose concavo-convex level difference is twice [more than] the thickness of a magnetic thin film.

[Claim 7] The master information carrier according to claim 1 or 2 by which the substrate layer has been arranged between silicon or a silicon oxide, and a magnetic thin film.

[Claim 8] The master information carrier according to claim 7 in which the component of a substrate layer adhered to the toothing-like side attachment wall.

[Claim 9] The master information carrier according to claim 7 which a substrate layer becomes from one ingredient chosen from the group which consists of Cr, aluminum, and Ti.

[Claim 10] The master information carrier according to claim 1 or 2 in which the magnetic thin film was formed using the vacuum deposition method or the sputtering method where the gas pressure near the base is set as 10 to 4 or less Torrs.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the master information carrier used in order to record a predetermined information signal on the magnetic-recording medium used for the magnetic recorder and reproducing device of mass and high recording density beforehand.
[0002]
[Description of the Prior Art] Current and a magnetic recorder and reproducing device are in the inclination of a raise in recording density, in order to realize what is small mass. It sets in the field of the hard disk drive which is a typical magnetic recorder and reproducing device, and surface recording density is already 1 Gbit/in2. The equipment which exceeds is commercialized and, several years after, it will be 10 Gbit/in2. An advance of a technique rapid like it argues about utilization of equipment is accepted.
[0003] As a technological background such whose high recording density-ization was attained, improvement in the track recording density by the appearance of new signal-processing methods, such as improvement in the engine performance of a magnetic-recording medium and head disk interface and a partial response, is mentioned. However, in recent years, the upward tendency of track density far exceeds the upward tendency of track recording density, and has become the main factors of improvement in surface recording density. Compared with the conventional induction type magnetic head, the playback output engine performance depends this on the far excellent utilization of a magnetic-resistance-element mold head. It is possible to have and reproduce a several [only] micrometers width-of-recording-track signal for a high S/N ratio by utilization of current and a magnetic-resistance-element mold head. On the other hand, it is expected with improvement in the further future head engine performance in the near future that a track pitch arrives at a submicron field.
[0004] In order for the magnetic head to scan such a narrow truck correctly and to reproduce a signal with a high S/N ratio, a role with the important tracking servo technique of the magnetic head is played. Such a tracking servo technique is indicated by "the high precision servo technique of the Yamaguchi:magnetic disk drive, the Magnetics Society of Japan, Vol.20, No.3, pp.771" (1996) at the detail, for example. According to this reference, by the present hard disk drive, the field (henceforth a "preformat record section") where it was made, 1 round, i.e., the include angle, of a disk, and the servo signal for tracking, the address information signal, the playback clock signal, etc. were recorded at intervals of the fixed include angle into 360 degrees is prepared. Thereby, the magnetic head reproduces these signals at fixed spacing, checks a self location, and it can scan a truck top correctly, correcting the variation rate in the direction of a path of a magnetic disk if needed.
[0005] Since preformat information signals, such as the above-mentioned servo signal for tracking and the above-mentioned address information signal, and a playback clock signal, turn into a reference signal for the magnetic head to scan a truck top correctly, exact truck positioning accuracy is required at the time of the record. For example, according to the contents indicated by "Uematsu, other:present condition [of a mechanism servo and a HDI technique], view, and 93rd time [of the Magnetics Society of Japan] study group data, 93-5, and pp.35" (1996) After incorporating a magnetic disk and the magnetic head in a drive in a current hard disk drive, Record of the servo signal for tracking, an address information signal, a playback clock signal, etc. is performed by the magnetic head of the proper incorporated in the drive using the servo-track recording apparatus of dedication. In this case, required truck positioning accuracy is realized by performing preformat record, carrying out position control of the magnetic head of the proper incorporated in the drive to a precision with the external actuator equipped by the servo-track recording apparatus.
[0006] Moreover, preformat record of such a servo signal for tracking, an address information signal, and a playback clock signal is similarly performed by the magnetic head using the servo-track recording device of dedication in the mass flexible disk commercialized in recent years and the medium for removable hard disks with a removable disk cartridge.
[0007] However, there were the following troubles in the Prior art which performs preformat record by the magnetic head of the proper incorporated in the drive using the servo-track recording apparatus of dedication.
[0008] Since the record by the magnetic head is line record by relative migration with the magnetic head and a magnetic-recording medium fundamentally, by the above-mentioned approach of recording, while carrying out position control of the magnetic head to a precision, preformat record takes [1st] much time amount to it using the servo-track recording device of dedication. Furthermore, since the servo-track recording device of dedication is quite expensive, the cost which preformat record takes becomes high.
[0009] This problem becomes so serious that the track density of a magnetic recorder and reproducing device improves. In addition to the number of trucks of the direction of a path of a disk increasing, the time amount

which preformat record takes also for the following reasons becomes long. That is, since high degree of accuracy is required of positioning of the magnetic head so that track density improves, include-angle spacing which prepares the preformat record section which records information signals, such as a servo signal for tracking, into 1 round of a disk, i.e., 360 degrees, must be made small. Therefore, the amount of signals which should carry out preformat record will increase in a disk as the equipment of high recording density, and it will take much time amount to it.

[0010] Moreover, although a magnetic-disk medium is in the inclination of minor-diameter-izing, there is also still much need over a major-diameter disk (3.5 inches and 5 inches). It is so necessary that the record area of a disk is large that the amount of signals which should carry out preformat record increases, and the time amount which preformat record takes has influenced greatly also about the cost performance of such a major-diameter disk.

[0011] Since it originates in the tip pole configuration of the spacing between the magnetic head and a magnetic-recording medium, or the magnetic head and a record field spreads [2nd], the magnetization transition of a truck edge by which preformat record was carried out lacks in steep nature.

[0012] Since the record by the magnetic head is dynamic line record by relative migration with the magnetic head and a magnetic-recording medium fundamentally, it cannot but form the spacing of a constant rate between the magnetic head and a magnetic-recording medium from a viewpoint of the interface engine performance between the magnetic head and a magnetic-recording medium. Moreover, since the current magnetic head is the structure of usually having two elements which bear record and playback separately, trailing-edge side pole width of face is large with several or more times of recording track width of face to the first transition side pole width of face of a record gap carrying out equality to recording track width of face.

[0013] The two above-mentioned troubles all become the factor which produces the breadth of a record field in a recording track edge. Consequently, the magnetization transition of a truck edge by which preformat record was carried out lacks in steep nature, or the problem that an elimination field is generated on truck edge both sides arises. With the current tracking servo technique, the location of the magnetic head is detected based on the variation of the playback output at the time of the magnetic head separating from it and scanning a truck. For this reason, it is required it not only excels in a S/N ratio when the magnetic head scans a truck top correctly like [at the time of reproducing the data signal recorded between servo fields], but that it should be steep, playback output variation, i.e., an off-track property, when the magnetic head separated from it and scans a truck. Therefore, if the magnetization transition of a truck edge by which preformat record was carried out as mentioned above lacks in steep nature, implementation of the exact tracking servo technique in future submicron truck record will become difficult.

[0014] Copy techniques, such as a tracking servo signal using for example, the magnetic-transfer technique as a technique which solves the former between the two above-mentioned troubles, are proposed (refer to JP,63-183623,A). If such a magnetic-transfer technique is used, the productivity in the case of preformat record will be improved. However, although this technique has comparatively low coercive force like a flexible disk and is effective in a magnetic-disk medium with small surface recording density, it cannot be used from hundreds of megabits to the high coercive force medium equipped with the resolution which bears the surface recording density of gigabit order like today's hard disk medium. In a magnetic-transfer technique, in order to secure imprint effectiveness, it is necessary to impress the AC bias field which has the about 1.5 times [of the coercive force of a transferred disk] amplitude. Since the master information recorded on the master disc is a magnetization pattern, in order for master information not to be demagnetized by this AC bias field, the value of about 3 times or more of the coercive force of a transferred disk is required as coercive force of a master disc. Since high surface recording density is borne, the coercive force of a current high density hard disk medium also has 1500 to 2500 oersted. Furthermore, in order to bear the surface recording density of future 10-gigabit order, it is expected that this value also becomes 3000 to 4000 oersted. That is, in the present condition, the coercive force of 9000 to 12000 oersted will be required of a master disc 4500 to 7500 oersted in the future. It is difficult from the field of selection of a magnetic material to realize such coercive force in a master disc. Furthermore, if the present magnetic-recording technique is used, master information is unrecordable on the master disc itself which has such high coercive force. Therefore, in the conventional magnetic-transfer technique, when a realizable coercive force value is taken into consideration in a master disc, constraint will be inevitably received in the coercive force of a transferred disk.

[0015] Moreover, the PURIEMBOSUTODISUKU technique of, forming in JP,7-153060,A the substrate for disk media which has the shape of toothing corresponding to the servo signal for tracking, an address information signal, a playback clock signal, etc. by La Stampa for example, and forming a magnetic layer on this substrate is indicated. This technique is both an effective solution to the two above-mentioned troubles. However, the shape of toothing on the front face of a disk affects the head surfacing property at the time of record playback (contact condition with a medium when [Or] it is contact record), and it is expected that a problem arises for the interface engine performance between the magnetic head and a magnetic-recording medium. Moreover, since the substrate manufactured by La Stampa is a plastic plate fundamentally, it cannot perform substrate heating at the time of magnetic layer membrane formation required for reservation of the medium engine performance, but also has the trouble that a required medium S/N ratio is not secured.

[0016] The very effective solution at the sacrifice of other important engine performance, such as a medium S/N ratio and interface engine performance, is not found out about two troubles described above from the above technological backgrounds.

[0017] The technique which enables preformat record is indicated by the basic principle target at U.S. Pat. No. 3,869,711, without sacrificing other important engine performance, such as a medium S/N ratio and interface engine performance, to the above technical problem. Moreover, this and a similar technique are indicated by JP,57-24032,A and JP,57-109134,A. As for each of these, the shape of toothing corresponding to an information signal is formed in the front face of a base. The front face of a master information carrier of the shape of this toothing where the heights front face was constituted with the ferromagnetic ingredient at least The magnetization pattern corresponding to the shape of toothing of the front face of a master information carrier is recorded on a magnetic-recording medium by making the front face of the shape of a sheet and disk-like magnetic-recording medium by which the ferromagnetic thin film or the ferromagnetic powder spreading layer was formed contact, or impressing a field further.
 [0018]
[Problem(s) to be Solved by the Invention] A photolithography technique is used for formation of the shape of toothing of the above-mentioned front face of a master information carrier. When the magnetic-recording medium preformatted is a hard disk, the magnitude of a master information carrier needs to be a hard disk and more than equivalent at least. Therefore, it is necessary to form a photoresist pattern with a sufficient precision over the large area of the base of a master information carrier. Under the present circumstances, when a photoresist is thick, it is very difficult to form the pattern of 1 micrometer or submicron order with high precision. For this reason, a thin resist pattern 1 micrometer or less needs to perform micro processing.
[0019] This invention is made in order to solve said technical problem in the conventional technique, and it aims at offering the master information carrier which can realize preformat record corresponding to the surface recording density of future 10-gigabit order.
[0020]
[Means for Solving the Problem] In order to attain said purpose, the shape of toothing corresponding to an information signal is formed in the front face of a base, it is the master information carrier of the shape of said toothing in which the magnetic thin film was formed on the surface of heights at least, said base consists of silicon or silicon oxide, and the 1st configuration of the master information carrier concerning this invention is characterized by processing the shape of said toothing using a reactive-ion-etching method or the reactant plasma-etching method. According to the 1st configuration of this master information carrier, it becomes possible to form the pattern of 1 micrometer or submicron order with high precision over the large area of the base of a master information carrier using a thin resist pattern 1 micrometer or less, and manufacture can realize the easy outstanding master information carrier cheaply.
[0021] Moreover, in the 1st configuration of the master information carrier of said this invention, a thing with the larger level difference of the irregularity in the shape of toothing than the thickness of a magnetic thin film is desirable. According to this desirable example, the outstanding master information carrier in which high signal record of a S/N ratio is possible is realizable. Moreover, it is desirable that a concavo-convex level difference is twice [more than] the thickness of a magnetic thin film in this case. According to this desirable example, the outstanding master information carrier in which the signal record with a still higher S/N ratio is possible is realizable.
[0022] Moreover, in the 1st configuration of the master information carrier of said this invention, it is desirable that the substrate layer is arranged between silicon or a silicon oxide, and a magnetic thin film. According to this desirable example, the reliable outstanding master information carrier is realizable. Moreover, it is desirable that the component of a substrate layer has adhered to the toothing-like side attachment wall in this case. According to this desirable example, since the component of a substrate layer will cover a toothing-like front face, electrification can be prevented and the outstanding master information carrier which can reduce adsorption of the dust by static electricity sharply can be realized. Moreover, it is desirable that a substrate layer consists of one ingredient chosen from the group which consists of Cr, aluminum, and Ti in this case.
[0023] Moreover, in the 1st configuration of the master information carrier of said this invention, a magnetic thin film is in the condition that the gas pressure near the base was set as 10 to 4 or less Torrs, and it is desirable to be formed using a vacuum deposition method or the sputtering method. According to this desirable example, it is highly precise and manufacture can realize the easy outstanding master information carrier cheaply.
[0024] Moreover, the 2nd configuration of the master information carrier concerning this invention The shape of toothing corresponding to an information signal is formed in the front face of a base, and it is the master information carrier of the shape of said toothing in which the magnetic thin film was formed on the surface of heights at least. The base material with which said base consists of one ingredient chosen from the group which consists of polymeric materials, a semiconductor material, a metallic material, and a ceramic ingredient, It consists of the silicon layer or silicon oxide layer formed on said base material, and is characterized by processing the shape of said toothing using a reactive-ion-etching method or the reactant plasma-etching method. According to the 2nd configuration of this master information carrier, the highly precise outstanding master information carrier is [that it is easy to use it] realizable.
[0025] Moreover, in the 2nd configuration of the master information carrier of said this invention, it is desirable that the interlayer is stationed between a base material, a silicon layer, or a silicon oxide layer. According to this desirable example, the outstanding master information carrier with easily highly precise manufacture is realizable with existence of an interlayer. moreover -- in this case -- an interlayer -- aluminum, Cr, Ti, Ta, Mo, W, and aluminum 2O3 from -- it is desirable to consist of one ingredient chosen from the becoming group.
[0026] Moreover, in the 2nd configuration of the master information carrier of said this invention, a thing with the larger level difference of the irregularity in the shape of toothing than the thickness of a magnetic thin film is

desirable. Moreover, it is desirable that a concavo-convex level difference is twice [more than] the thickness of a magnetic thin film in this case.
[0027] Moreover, in the 2nd configuration of the master information carrier of said this invention, it is desirable that the substrate layer is arranged between silicon or a silicon oxide, and a magnetic thin film. Moreover, it is desirable that the component of a substrate layer has adhered to the toothing-like side attachment wall in this case. Moreover, it is desirable that a substrate layer consists of one ingredient chosen from the group which consists of Cr, aluminum, and Ti in this case.
[0028] Moreover, in the 2nd configuration of the master information carrier of said this invention, a magnetic thin film is in the condition that the gas pressure near the base was set as 10 to 4 or less Torrs, and it is desirable to be formed using a vacuum deposition method or the sputtering method.
[0029]
[Embodiment of the Invention] Hereafter, this invention is explained still more concretely using the gestalt of operation. First, the preformat record using the master information carrier of this invention is explained briefly, referring to drawing 1 . Drawing 1 is a schematic diagram for explaining the record principle which used the master information carrier of this invention.
[0030] The magnetization pattern corresponding to the shape of toothing of a master information carrier is recorded on a magnetic-recording medium by the record field generated with the ferromagnetic ingredient of the heights of the front face of the master information carrier magnetized by the one direction. This situation is shown in drawing 1 . That is, the shape of toothing corresponding to the servo signal for tracking, an address information signal, a playback clock signal, etc. is formed in the front face of the master information carrier 2. Here, the front face of toothing-like heights is constituted by the ferromagnetic ingredient. Induction of the magnetization 3 is carried out to the ferromagnetic ingredient on the front face of heights by the excitation field 4, the imprint field 5 occurs to the magnetic-recording medium 1, and the magnetic-recording medium 1 is magnetized by this magnetization 3 by which induction was carried out. And the residual magnetization corresponding to these remains in the magnetic-recording medium 1, and preformat record is carried out.
[0031] <Gestalt of the 1st operation> Below, the master information carrier in the gestalt of operation of the 1st of this invention is explained, referring to drawing 2 . Drawing 2 is the outline sectional view showing the configuration of the master information carrier in the gestalt of operation of the 1st of this invention.
[0032] As shown in drawing 2 , the shape of toothing corresponding to a master information pattern is formed in the front face of the base 6 which consists of silicon or a silicon oxide. The heights magnetic thin film 8 is formed in the front face of the toothing-like heights 7, and the crevice magnetic thin film 9 is formed in the front face of a crevice 14.
[0033] The shape of toothing of the front face of a base 6 is formed of the following processes. First, a spin coater or a spray coater is used for the front face of a base 6, and a photosensitive resist is applied to it. As for the coating thickness of a photosensitive resist, it is desirable that they are 1.0 micrometers or less and 0.5 more micrometers or less. If the coating thickness of a photosensitive resist is too thick, it will become difficult to perform detailed patterning 1.0 micrometers or less with a sufficient controllability. In reactant etching, the processing depth realized with high precision is 0.5 to 1.0 times the thickness of a resist.
[0034] Subsequently, the resist film is exposed and developed. In addition, if needed, prebaking etc. is pretreated before exposure and after treatment, such as postbake, is performed after exposure. The exposure technique generally used conventionally is used for exposure. It becomes possible [if a pattern pitch is the level which is several micrometers the one-shot exposure by the projection is possible, and] to draw with a convergent laser light, if a pattern pitch is about 1.0 micrometers. furthermore -- the case where a pattern pitch is submicron order -- convergence electronic drawing -- exposure is performed using a drawing technique. The paddle developing-negatives method and the spray developing-negatives method are used for development. Washing processing is performed after development termination and UV irradiation processing is performed if needed.
[0035] Subsequently, the base 6 which patterning of a resist completed is etched by the etching system. A reactive-ion-etching method or the reactant plasma-etching method is used for etching. reactive ion etching -- rare gas, such as Ar, -- CF4 etc. -- ionize reactant gas, accelerate, a substrate is made to come flying, and it is carried out by making silicon (base 6) and reactant gas react. Vapor pressure of a resultant is high, and it serves as gas and is removed promptly. Therefore, a resist remains, without reacting. Moreover, it is accelerated, and since rectilinear-propagation nature is high, directive high etching is possible for ion. On the other hand, reactant plasma etching is performed by impressing the electromagnetic field of high frequency to the mixed gas of rare gas, such as Ar, and the reactant gas of CF4 grade, and, thereby, the plasma of high density is generated near the base 6. Induction of the bias potential is carried out to a base 6 by this plasma, with this potential, the ion in the plasma is accelerated and a base 6 is reached. If ion arrives at the front face of the silicon base 6, like the case of the above-mentioned reactive ion etching, silicon (base 6) and reactant gas react, and a resultant will serve as gas and will be removed promptly. Therefore, a resist remains also in this case, without reacting. Moreover, it is accelerated, and since rectilinear-propagation nature is high, directive high etching is possible for ion.
[0036] Subsequently, a residual resist is removed after the completion of etching using the remover agent which suited the resist agent. On the occasion of removal of a resist, a plasma asher performs rough **** of a resist in advance if needed.
[0037] The shape of toothing with good dimensional accuracy is formed in the front face of the silicon base 6 in Sharp corresponding to a master information pattern as mentioned above. It is still more sharp, and in order to

form the shape of toothing with good dimensional accuracy, it is desirable to etch by using a chromium thin film as a mask.
[0038] Subsequently, the chromium film is formed on the front face of a base 6 in which the shape of toothing was formed. And after applying a resist to the front face of the chromium film, a resist pattern is formed like the above. The thickness of a resist is set up the more than twice of chromium thickness. After forming a resist pattern, a chromium pattern is formed using ion etching or wet etching. After forming a chromium pattern, a residual resist is removed if needed. Then, the shape of toothing is formed in the front face of a base 6 like the above using reactive ion etching or reactant plasma etching. At this time, the processing depth is permitted up to ten to 20 times of the thickness of a chromium film mask.
[0039] Subsequently, a magnetic thin film is formed in the front face which has the shape of toothing of a base 6. As an ingredient of a magnetic thin film, Fe system microcrystal ingredients, such as an amorphous material of Co radicals, such as crystal ingredients, such as nickel-Fe and Fe-aluminum-Si, and Co-Zr-Nb, and Fe-Ta-N, Fe and Co, Fe-Co, etc. are desirable. In forming a magnetic thin film, the following points are important.
[0040] In forming a magnetic thin film, one of the important points is control of adhesion of the magnetic substance on a heights side attachment wall. That is, since the dimensional accuracy of heights will fall and magnetic association with the heights magnetic thin film 8 and the crevice magnetic thin film 9 will strengthen when a lot of magnetic substance adheres to a heights side attachment wall, adhesion of the magnetic substance on a heights side attachment wall must be controlled. In this case, it is necessary to control adhesion of the magnetic substance on a heights side attachment wall to ten or less percent of the thickness of the heights magnetic thin film 8 or the crevice magnetic thin film 9.
[0041] As the formation approach of the magnetic thin film which can control adhesion of the magnetic substance on a heights side attachment wall as mentioned above, there is vacuum evaporation technique, an ion beam spatter method, or the opposite target spatter method. Any approach is an approach that the gas pressure near [at the time of forming the film] the base front face can be stopped low. That is, it is the comparatively long membrane formation approach of an atomic mean free path that the atom which flies to a base front face collides with gas on the way, and are not scattered about. Therefore, if such conditions are satisfied, the membrane formation approaches other than the three above-mentioned membrane formation approaches can also be used.
[0042] When the gas pressure near [under membrane formation] the base was 10 to 4 or less Torrs as a result of the experiment, it turned out that adhesion of the magnetic substance on a heights side attachment wall can be controlled to ten or less percent of the thickness of the heights magnetic thin film 8 or the crevice magnetic thin film 9.
[0043] In forming a magnetic thin film, other one of the important points is the physical relationship of the heights magnetic thin film 8 and the crevice magnetic thin film 9. This is related to the toothing-like level difference and the thickness of a magnetic thin film which were formed in the front face of a base 6. Let desirable thickness of the heights magnetic thin film 8 be the range of 0.1 to 0.5 micrometers in the master information carrier. When a toothing-like level difference is smaller than the thickness of a magnetic thin film, the heights magnetic thin film 8 and the crevice magnetic thin film 9 will continue. In such a case, it becomes it is too strong and inadequate signal recording magnetic association with the heights magnetic thin film 8 and the crevice magnetic thin film 9 on the magnetic-recording medium by the master information carrier. Therefore, as for a toothing-like level difference, what is larger than the thickness of a magnetic thin film is desirable. Furthermore, as for a toothing-like level difference, it is desirable that it is twice [more than] the thickness of a magnetic thin film. Even if physically separated from this of the heights magnetic thin film 8 and the crevice magnetic thin film 9, it is because magnetic association exists if the distance is small.
[0044] <Gestalt of the 2nd operation> Below, the master information carrier in the gestalt of operation of the 2nd of this invention is explained, referring to drawing 3 . Drawing 3 is the outline sectional view showing the configuration of the master information carrier in the gestalt of operation of the 2nd of this invention.
[0045] In forming a magnetic thin film, a still more important point is forming the substrate layer 10, before forming a magnetic thin film 8. The substrate layer 10 serves to improve the bond strength of a magnetic thin film 8. It cannot be overemphasized that an improvement of bond strength contributes to improvement in the dependability of a master information carrier and endurance greatly. The configuration of drawing 3 has the dependability of a master information carrier higher than the configuration of drawing 2 . Metallic materials, such as Cr, aluminum, Ti, etc. whose bonding strength with silicon or a silicon oxide is nonmagnetic strongly as an ingredient of the substrate layer 10, are desirable.
[0046] The substrate layer 10 demonstrates function with the thickness sufficient by about 0.02 micrometers from 0.01 micrometers. Thus, in formation of the thin film, since the film coating weight to a heights side attachment wall is so small that it can be disregarded, he does not need to examine the forming-membranes method severely like a magnetic thin film 8. It is desirable to make furring adhere to a heights side attachment wall positively as a magnetic thin film 8, as conversely shown in drawing 4 , and to take an electric flow over the whole front face in formation of the substrate layer 10. Thereby, electrification can be prevented and adsorption of the dust by static electricity can be reduced sharply. What is necessary is just to use the usual spatter approach or vacuum deposition which can form membranes on a 10-3Torr base, in order to form such a substrate layer 10.
[0047] According to a series of above-mentioned processes, an easy and cheaply highly precise master information carrier can be manufactured, and according to the master information carrier which carried out in

this way and was manufactured, the signal record which has a high S/N ratio is attained.
[0048] <Gestalt of the 3rd operation> Below, the master information carrier in the gestalt of operation of the 3rd of this invention is explained, referring to drawing 5 . Drawing 5 is the outline sectional view showing an example of the production process of the master information carrier in the gestalt of operation of the 3rd of this invention.
[0049] The whole does not consist of silicon or a silicon oxide, but the base in the gestalt of this operation is constituted by the base base material section 11 and the base surface section 12. As the base base material section 11, non-magnetic materials, such as polymeric materials, a semiconductor material, a metallic material, or a ceramic ingredient, are used. As shown in drawing 5 (a), on this base base material section 11, silicon or a silicon oxide is formed as the base surface section 12. And as shown in drawing 5 (b), only the base surface section 12 is processed in the shape of toothing. Seven are heights among drawing 5 (b). Thus, after processing a base, a magnetic thin film is formed in the front face as mentioned above.
[0050] Drawing 6 is the outline sectional view showing other examples of the production process of the master information carrier in the gestalt of operation of the 3rd of this invention. As shown in drawing 6 , in order to mainly improve adhesion force and to raise dependability, between the base base material section 11 and the base surface section 12, the interlayer 13 is stationed for the purpose of the fault etching prevention at the time of etching. As an interlayer's 13 ingredient, they are aluminum, Cr, Ti, Ta, Mo, W, and aluminum 2O3. It is desirable.
[0051] The advantage which constitutes a base by the base base material section 11 and the base surface section 12 is as follows. First, compared with silicon or a silicon oxide, a cheap ingredient can be used as an ingredient of a base. For example, aluminum and an aluminium alloy with it can be used. [high versatility and] [cheap] And an equivalent precision is secured in a process equivalent to the case where toothing-like processing uses only silicon and a silicon oxide as an ingredient of a base.
[0052] Next, a mechanical strength and machinability are improvable. If a polymeric-materials metallurgy group ingredient is used as an ingredient of the base base material section 11, the tough nature obtained only neither with silicon nor a silicon oxide can be given to a master information carrier. It is improved at the time of using a master information carrier, for example, workability, such as an installation guidance device.
[0053] Next, toothing-like workability improves. For example, CF4 In used reactant etching, silicon or silicon oxide is etched into a high speed, but other ingredients have an extremely slow etch rate. That is, if the thickness of the base surface section 12 is managed, since the depth of a crevice will serve as thickness of the base surface section 12, the repeatability of a depth dimension improves.
[0054] Next, the adhesion of a master information carrier and a magnetic-recording medium improves. For example, if polymeric materials are used as an ingredient of the base base material section 11, since the flexibility of minute level will be given to a master information carrier, adhesion with a hard disk medium is improved.
[0055] In addition, in the gestalt of the above-mentioned implementation, although the magnetic thin film is formed in the front face of the both sides of the heights of a base, and a crevice, it is not necessarily limited to the master information carrier of this configuration, and the magnetic thin film should just be formed in the front face of a concavo-convex configuration which is heights at least.
[0056]
[Effect of the Invention] As explained above, according to this invention, the master information carrier in which the detailed pattern 1.0 micrometers or less was formed with repeatability often [precision] and sufficient is realizable, having tough nature, flexibility, dust removal nature, etc.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the master information carrier used in order to record a predetermined information signal on the magnetic-recording medium used for the magnetic recorder and reproducing device of mass and high recording density beforehand.

[Translation done.]

PRIOR ART

[Description of the Prior Art] Current and a magnetic recorder and reproducing device are in the inclination of a raise in recording density, in order to realize what is small mass. It sets in the field of the hard disk drive which is a typical magnetic recorder and reproducing device, and surface recording density is already 1 Gbit/in2. The equipment which exceeds is commercialized and, several years after, it will be 10 Gbit/in2. An advance of a technique rapid like it argues about utilization of equipment is accepted.

[0003] As a technological background such whose high recording density-ization was attained, improvement in the track recording density by the appearance of new signal-processing methods, such as improvement in the engine performance of a magnetic-recording medium and head disk interface and a partial response, is mentioned. However, in recent years, the upward tendency of track density far exceeds the upward tendency of track recording density, and has become the main factors of improvement in surface recording density. Compared with the conventional induction type magnetic head, the playback output engine performance depends this on the far excellent utilization of a magnetic-resistance-element mold head. It is possible to have and reproduce a several [only] micrometers width-of-recording-track signal for a high S/N ratio by utilization of current and a magnetic-resistance-element mold head. On the other hand, it is expected with improvement in the further future head engine performance in the near future that a track pitch arrives at a submicron field.

[0004] In order for the magnetic head to scan such a narrow truck correctly and to reproduce a signal with a high S/N ratio, a role with the important tracking servo technique of the magnetic head is played. Such a tracking servo technique is indicated by "the high precision servo technique of the Yamaguchi:magnetic disk drive, the Magnetics Society of Japan, Vol.20, No.3, pp.771" (1996) at the detail, for example. According to this reference, by the present hard disk drive, the field (henceforth a "preformat record section") where it was made, 1 round, i.e., the include angle, of a disk, and the servo signal for tracking, the address information signal, the playback clock signal, etc. were recorded at intervals of the fixed include angle into 360 degrees is prepared. Thereby, the magnetic head reproduces these signals at fixed spacing, checks a self location, and it can scan a truck top correctly, correcting the variation rate in the direction of a path of a magnetic disk if needed.

[0005] Since preformat information signals, such as the above-mentioned servo signal for tracking and the above-mentioned address information signal, and a playback clock signal, turn into a reference signal for the magnetic head to scan a truck top correctly, exact truck positioning accuracy is required at the time of the record. For example, the magnetic head of the proper which according to the contents indicated by "Uematsu, other:present condition [of a mechanism servo and a HDI technique], view, and 93rd time [of the Magnetics Society of Japan] study group data, 93-5, and pp.35" (1996) was incorporated in the drive by the current hard disk drive using the servo-track recording apparatus of dedication after incorporating a magnetic disk and the magnetic head in a drive Record of the servo signal for tracking, an address information signal, a playback clock signal, etc. is performed. In this case, required truck positioning accuracy is realized by performing preformat record, carrying out position control of the magnetic head of the proper incorporated in the drive to a precision with the external actuator equipped by the servo-track recording apparatus.

[0006] Moreover, preformat record of such a servo signal for tracking, an address information signal, and a playback clock signal is similarly performed by the magnetic head using the servo-track recording device of dedication in the mass flexible disk commercialized in recent years and the medium for removable hard disks with a removable disk cartridge.

[0007] However, there were the following troubles in the Prior art which performs preformat record by the magnetic head of the proper incorporated in the drive using the servo-track recording apparatus of dedication.

[0008] Since the record by the magnetic head is line record by relative migration with the magnetic head and a magnetic-recording medium fundamentally, by the above-mentioned approach of recording, while carrying out position control of the magnetic head to a precision, preformat record takes [1st] much time amount to it using the servo-track recording device of dedication. Furthermore, since the servo-track recording device of dedication is quite expensive, the cost which preformat record takes becomes high.

[0009] This problem becomes so serious that the track density of a magnetic recorder and reproducing device improves. In addition to the number of trucks of the direction of a path of a disk increasing, the time amount which preformat record takes also for the following reasons becomes long. That is, since high degree of accuracy is required of positioning of the magnetic head so that track density improves, include-angle spacing which prepares the preformat record section which records information signals, such as a servo signal for tracking, into 1 round of a disk, i.e., 360 degrees, must be made small. Therefore, the amount of signals which should carry out preformat record will increase in a disk as the equipment of high recording density, and it will take much time amount to it.

[0010] Moreover, although a magnetic-disk medium is in the inclination of minor-diameter-izing, there is also still much need over a major-diameter disk (3.5 inches and 5 inches). It is so necessary that the record area of a disk is large that the amount of signals which should carry out preformat record increases, and the time amount which preformat record takes has influenced greatly also about the cost performance of such a major-diameter disk.
[0011] Since it originates in the tip pole configuration of the spacing between the magnetic head and a magnetic-recording medium, or the magnetic head and a record field spreads [2nd], the magnetization transition of a truck edge by which preformat record was carried out lacks in steep nature.
[0012] Since the record by the magnetic head is dynamic line record by relative migration with the magnetic head and a magnetic-recording medium fundamentally, it cannot but form the spacing of a constant rate between the magnetic head and a magnetic-recording medium from a viewpoint of the interface engine performance between the magnetic head and a magnetic-recording medium. Moreover, since the current magnetic head is the structure of usually having two elements which bear record and playback separately, trailing-edge side pole width of face is large with several or more times of recording track width of face to the first transition side pole width of face of a record gap carrying out equality to recording track width of face.
[0013] The two above-mentioned troubles all become the factor which produces the breadth of a record field in a recording track edge. Consequently, the magnetization transition of a truck edge by which preformat record was carried out lacks in steep nature, or the problem that an elimination field is generated on truck edge both sides arises. With the current tracking servo technique, the location of the magnetic head is detected based on the variation of the playback output at the time of the magnetic head separating from it and scanning a truck. For this reason, it is required it not only excels in a S/N ratio when the magnetic head scans a truck top correctly like [at the time of reproducing the data signal recorded between servo fields], but that it should be steep, playback output variation, i.e., an off-track property, when the magnetic head separated from it and scans a truck. Therefore, if the magnetization transition of a truck edge by which preformat record was carried out as mentioned above lacks in steep nature, implementation of the exact tracking servo technique in future submicron truck record will become difficult.
[0014] Copy techniques, such as a tracking servo signal using for example, the magnetic-transfer technique as a technique which solves the former between the two above-mentioned troubles, are proposed (refer to JP,63-183623,A). If such a magnetic-transfer technique is used, the productivity in the case of preformat record will be improved. However, although this technique has comparatively low coercive force like a flexible disk and is effective in a magnetic-disk medium with small surface recording density, it cannot be used from hundreds of megabits to the high coercive force medium equipped with the resolution which bears the surface recording density of gigabit order like today's hard disk medium. In a magnetic-transfer technique, in order to secure imprint effectiveness, it is necessary to impress the AC bias field which has the about 1.5 times [of the coercive force of a transferred disk] amplitude. Since the master information recorded on the master disc is a magnetization pattern, in order for master information not to be demagnetized by this AC bias field, the value of about 3 times or more of the coercive force of a transferred disk is required as coercive force of a master disc. Since high surface recording density is borne, the coercive force of a current high density hard disk medium also has 1500 to 2500 oersted. Furthermore, in order to bear the surface recording density of future 10-gigabit order, it is expected that this value also becomes 3000 to 4000 oersted. That is, in the present condition, the coercive force of 9000 to 12000 oersted will be required of a master disc 4500 to 7500 oersted in the future. It is difficult from Men of selection of a magnetic material to realize such coercive force in a master disc. Furthermore, if the present magnetic-recording technique is used, master information is unrecordable on the master disc itself which has such high coercive force. Therefore, in the conventional magnetic-transfer technique, when a realizable coercive force value is taken into consideration in a master disc, constraint will be inevitably received in the coercive force of a transferred disk.
[0015] Moreover, the PURIEMBOSUTODISUKU technique of, forming in JP,7-153060,A the substrate for disk media which has the shape of toothing corresponding to the servo signal for tracking, an address information signal, a playback clock signal, etc. by La Stampa for example, and forming a magnetic layer on this substrate is indicated. This technique is both an effective solution to the two above-mentioned troubles. However, the shape of toothing on the front face of a disk affects the head surfacing property at the time of record playback (contact condition with a medium when [Or] it is contact record), and it is expected that a problem arises for the interface engine performance between the magnetic head and a magnetic-recording medium. Moreover, since the substrate manufactured by La Stampa is a plastic plate fundamentally, it cannot perform substrate heating at the time of magnetic layer membrane formation required for reservation of the medium engine performance, but also has the trouble that a required medium S/N ratio is not secured.
[0016] The very effective solution at the sacrifice of other important engine performance, such as a medium S/N ratio and interface engine performance, is not found out about two troubles described above from the above technological backgrounds.
[0017] The technique which enables preformat record is indicated by the basic principle target at U.S. Pat. No. 3,869,711, without sacrificing other important engine performance, such as a medium S/N ratio and interface engine performance, to the above technical problem. Moreover, this and a similar technique are indicated by JP,57-24032,A and JP,57-109134,A. For each of these, even if the shape of toothing corresponding to an information signal is formed in the front face of a base and there is little shape of this toothing, a heights front face is a ferromagnetic ingredient. The magnetization pattern corresponding to the shape of toothing of the front

face of a master information carrier is recorded on a magnetic-recording medium by contacting the front face of the constituted master information carrier on the front face of the shape of a sheet and disk-like magnetic-recording medium by which the ferromagnetic thin film or the ferromagnetic powder spreading layer was formed, or impressing a field further.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to this invention, the master information carrier in which the detailed pattern 1.0 micrometers or less was formed with repeatability often [precision] and sufficient is realizable, having tough nature, flexibility, dust removal nature, etc.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] A photolithography technique is used for formation of the shape of toothing of the above-mentioned front face of a master information carrier. When the magnetic-recording medium preformatted is a hard disk, the magnitude of a master information carrier needs to be a hard disk and more than equivalent at least. Therefore, it is necessary to form a photoresist pattern with a sufficient precision over the large area of the base of a master information carrier. Under the present circumstances, when a photoresist is thick, it is very difficult to form the pattern of 1 micrometer or submicron order with high precision. For this reason, a thin resist pattern 1 micrometer or less needs to perform micro processing.
[0019] This invention is made in order to solve said technical problem in the conventional technique, and it aims at offering the master information carrier which can realize preformat record corresponding to the surface recording density of future 10-gigabit order.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is a schematic diagram for explaining the record principle using the master information carrier of this invention.
[Drawing 2] It is the outline sectional view showing the configuration of the master information carrier in the gestalt of operation of the 1st of this invention.
[Drawing 3] It is the outline sectional view showing the configuration of the master information carrier in the gestalt of operation of the 2nd of this invention.
[Drawing 4] It is the outline sectional view showing the configuration of the value of the master information carrier in the gestalt of operation of the 2nd of this invention.
[Drawing 5] It is the outline sectional view showing an example of the production process of the master information carrier in the gestalt of operation of the 3rd of this invention.
[Drawing 6] It is the outline sectional view showing other examples of the production process of the master information carrier in the gestalt of operation of the 3rd of this invention.
[Description of Notations]
1 Magnetic-Recording Medium
2 Master Information Carrier
3 Magnetization in which Induction was Carried Out to Heights Magnetic Substance by Excitation Field
4 Excitation Field
5 Imprint Field
6 Base
7 Heights
8 Heights Magnetic Thin Film
9 Crevice Magnetic Thin Film
10 Substrate Layer
11 Base Base Material Section
12 Base Surface Section
13 Interlayer

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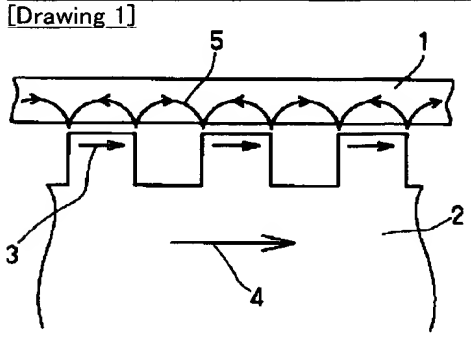
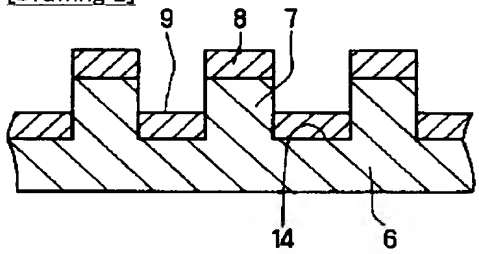
DRAWINGS

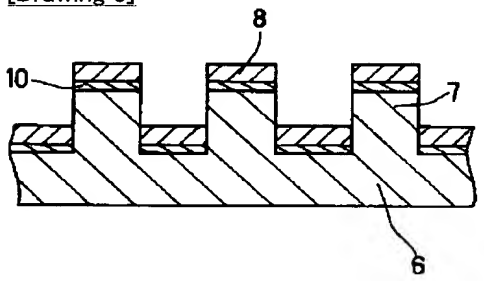
[Drawing 1]



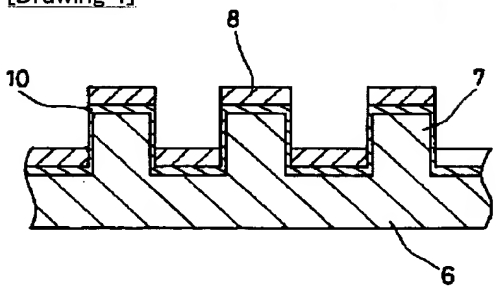
[Drawing 2]



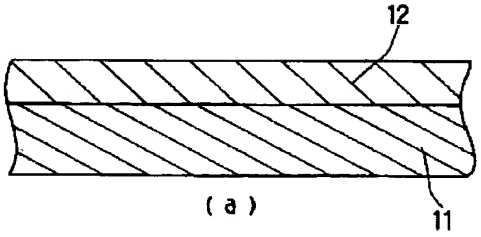
[Drawing 3]

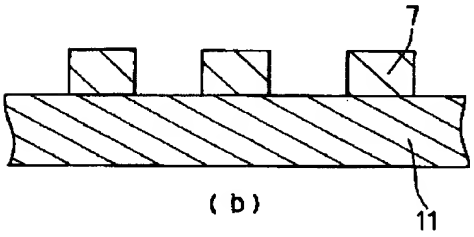


[Drawing 4]

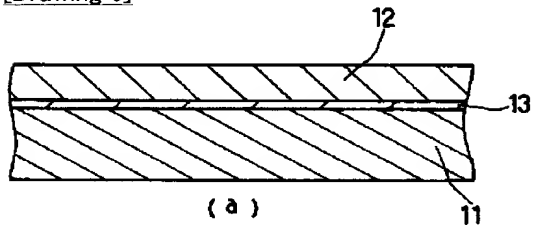


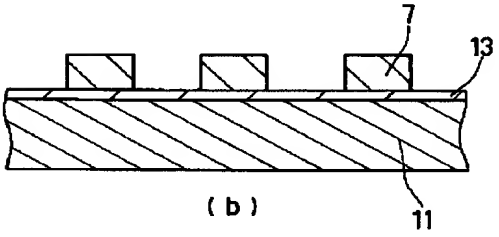
[Drawing 5]





[Drawing 6]





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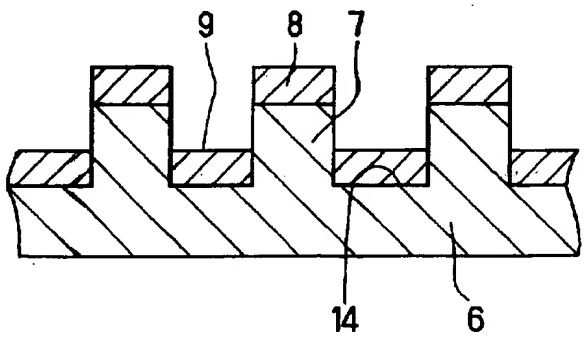
最終頁に続く

(54)【発明の名称】　マスター情報担体

(57)【要約】

【課題】　将来の１０ギガビットオーダーの面記録密度に対応したプリフォーマット記録を実現可能なマスター情報担体を提供する。

【解決手段】　シリコンもしくはシリコン酸化物からなる基体６の表面に、マスター情報パターンに対応した凹凸形状を形成する。凹凸形状の少なくとも凸部７の表面に磁性薄膜８を形成する。基体６をシリコンもしくはシリコン酸化物で作製し、反応性イオンエッチング法もしくは反応性プラズマエッチング法を用いて凹凸形状を加工した後に、磁性薄膜８を形成する。



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【特許請求の範囲】

【請求項１】　基体の表面に情報信号に対応する凹凸形状が形成され、前記凹凸形状の少なくとも凸部の表面に磁性薄膜が形成されたマスター情報担体であって、前記基体がシリコンもしくはシリコン酸化物からなり、前記凹凸形状が反応性イオンエッチング法もしくは反応性プラズマエッチング法を用いて加工されたことを特徴とするマスター情報担体。

【請求項２】　基体の表面に情報信号に対応する凹凸形状が形成され、前記凹凸形状の少なくとも凸部の表面に磁性薄膜が形成されたマスター情報担体であって、前記基体が、高分子材料、半導体材料、金属材料及びセラミックス材料からなる群から選ばれた１つの材料からなる母材と、前記母材の上に形成されたシリコン層もしくはシリコン酸化物層とからなり、前記凹凸形状が反応性イオンエッチング法もしくは反応性プラズマエッチング法を用いて加工されたことを特徴とするマスター情報担体。

【請求項３】　母材とシリコン層もしくはシリコン酸化物層との間に中間層が配置された請求項２に記載のマスター情報担体。

【請求項４】　中間層が、Ａｌ、Ｃｒ、Ｔｉ、Ｔａ、Ｍｏ、Ｗ及びAl_2O_3からなる群から選ばれた１つの材料からなる請求項３に記載のマスター情報担体。

【請求項５】　凹凸形状における凹凸の段差が磁性薄膜の膜厚よりも大きい請求項１又は２に記載のマスター情報担体。

【請求項６】　凹凸の段差が磁性薄膜の膜厚の２倍以上である請求項５に記載のマスター情報担体。

【請求項７】　シリコンもしくはシリコン酸化物と磁性薄膜との間に下地層が配置された請求項１又は２に記載のマスター情報担体。

【請求項８】　下地層の成分が凹凸形状の側壁に付着した請求項７に記載のマスター情報担体。

【請求項９】　下地層が、Ｃｒ、Ａｌ及びＴｉからなる群から選ばれた１つの材料からなる請求項７に記載のマスター情報担体。

【請求項１０】　磁性薄膜が、基体近傍のガス圧が10^{-4}Ｔｏｒｒ以下に設定された状態で、真空蒸着法もしくはスパッタリング法を用いて形成された請求項１又は２に記載のマスター情報担体。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、大容量で高記録密度の磁気記録再生装置に用いられる磁気記録媒体に所定の情報信号を予め記録するために用いられるマスター情報担体に関する。

【０００２】

【従来の技術】現在、磁気記録再生装置は、小型でかつ大容量のものを実現するために、高記録密度化の傾向にある。代表的な磁気記録再生装置であるハードディスクドライブの分野においては、すでに面記録密度が１Ｇｂｉｔ／ｉｎ^{2}を超える装置が商品化されており、数年後には、１０Ｇｂｉｔ／ｉｎ^{2}の装置の実用化が議論されるほどの急激な技術の進歩が認められる。

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【０００３】このような高記録密度化が可能となった技術的背景として、磁気記録媒体及びヘッド・ディスクインターフェースの性能の向上やパーシャルレスポンス等の新規な信号処理方式の出現による線記録密度の向上が挙げられる。しかし、近年では、トラック密度の増加傾向が線記録密度の増加傾向を大きく上回り、面記録密度の向上の主な要因となっている。これは、従来の誘導型磁気ヘッドに比べて再生出力性能がはるかに優れた磁気抵抗素子型ヘッドの実用化によるものである。現在、磁気抵抗素子型ヘッドの実用化により、わずか数μｍのトラック幅信号を高いＳ／Ｎ比をもって再生することが可能となっている。一方、今後のさらなるヘッド性能の向上に伴い、近い将来には、トラックピッチがサブミクロン領域に達するものと予想されている。

【０００４】磁気ヘッドがこのような狭いトラックを正確に走査し、高いＳ／Ｎ比をもって信号を再生するためには、磁気ヘッドのトラッキングサーボ技術が重要な役割を果たす。このようなトラッキングサーボ技術に関しては、例えば、『山口：磁気ディスク装置の高精度サーボ技術、日本応用磁気学会誌、Vol.20,No.3,pp.771,(1996)』に詳細に記載されている。この文献によれば、現在のハードディスクドライブでは、ディスクの１周、すなわち角度にして３６０度中に、一定の角度間隔でトラッキング用サーボ信号、アドレス情報信号、再生クロック信号等が記録された領域（以下『プリフォーマット記録領域』という。）が設けられている。これにより、磁気ヘッドは、一定の間隔でこれらの信号を再生して自己の位置を確認し、磁気ディスクの径方向における変位を必要に応じて修正しながら正確にトラック上を走査することができる。

【０００５】上記したトラッキング用サーボ信号、アドレス情報信号、再生クロック信号等のプリフォーマット情報信号は、磁気ヘッドが正確にトラック上を走査するための基準信号となるものであるから、その記録時には、正確なトラック位置決め精度が要求される。例えば、『植松、他：メカ・サーボ、ＨＤＩ技術の現状と展望、日本応用磁気学会第９３回研究会資料、93-5，pp.35 (1996)』に記載された内容によれば、現在のハードディスクドライブでは、磁気ディスク及び磁気ヘッドをドライブ内に組み込んだ後、専用のサーボトラック記録装置を用いて、ドライブ内に組み込まれた固有の磁気ヘッドによりトラッキング用サーボ信号、アドレス情報信号、再生クロック信号等の記録が行われている。この場合、ドライブ内に組み込まれた固有の磁気ヘッドを、サーボトラック記録装置に装備された外部アクチュエータ

によって精密に位置制御しながらプリフォーマット記録を行うことにより、必要なトラック位置決め精度が実現されている。

【０００６】また、このようなトラッキング用サーボ信号、アドレス情報信号、再生クロック信号のプリフォーマット記録は、近年商品化された大容量フレキシブルディスクや、ディスクカートリッジが着脱可能なリムーバブルハードディスク用媒体においても、同様に専用のサーボトラック記録装置を用いて磁気ヘッドにより行われている。

【０００７】しかし、専用のサーボトラック記録装置を用い、ドライブ内に組み込まれた固有の磁気ヘッドによってプリフォーマット記録を行う従来の技術には、以下のような問題点があった。

【０００８】第１に、磁気ヘッドによる記録は、基本的に磁気ヘッドと磁気記録媒体との相対的な移動による線記録であるため、専用のサーボトラック記録装置を用い、磁気ヘッドを精密に位置制御しながら記録を行う上記方法では、プリフォーマット記録に多くの時間を要する。さらに、専用のサーボトラック記録装置はかなり高価であるため、プリフォーマット記録に要するコストが高くなる。

【０００９】この問題は、磁気記録再生装置のトラック密度が向上するほど深刻になる。ディスクの径方向のトラック数が増加することに加えて、以下の理由によってもプリフォーマット記録に要する時間が長くなる。すなわち、トラック密度が向上するほど磁気ヘッドの位置決めに高精度が要求されるため、ディスクの１周、すなわち３６０度中においてトラッキング用サーボ信号等の情報信号を記録するプリフォーマット記録領域を設ける角度間隔を小さくしなければならない。従って、高記録密度の装置ほどディスクにプリフォーマット記録すべき信号量が多くなり、多くの時間を要することになる。

【００１０】また、磁気ディスク媒体は小径化の傾向にあるものの、依然として３．５インチや５インチの大径ディスクに対する需要も多い。ディスクの記録面積が大きいほどプリフォーマット記録すべき信号量が多くなるのは必然であり、このような大径ディスクのコストパフォーマンスに関しても、プリフォーマット記録に要する時間が大きく影響している。

【００１１】第２に、磁気ヘッドと磁気記録媒体との間のスペーシングや磁気ヘッドの先端ポール形状に起因して記録磁界が広がるため、プリフォーマット記録されたトラック端部の磁化遷移が急峻性に欠ける。

【００１２】磁気ヘッドによる記録は、基本的に磁気ヘッドと磁気記録媒体との相対的な移動による動的な線記録であるため、磁気ヘッドと磁気記録媒体との間のインターフェース性能の観点から、磁気ヘッドと磁気記録媒体との間に一定量のスペーシングを設けざるを得ない。また、現在の磁気ヘッドは、通常、記録と再生を別々に担う２つのエレメントを有する構造であるため、記録ギャップの前縁側ポール幅が記録トラック幅に相等するのに対し、後縁側ポール幅が記録トラック幅の数倍以上と大きくなっている。

【００１３】上記２つの問題点は、いずれも、記録トラック端部において記録磁界の広がりを生じさせる要因となる。その結果、プリフォーマット記録されたトラック端部の磁化遷移が急峻性に欠ける、あるいはトラック端両側に消去領域が生じるといった問題が生じる。現在のトラッキングサーボ技術では、磁気ヘッドがトラックを外れて走査した際の再生出力の変化量に基づいて磁気ヘッドの位置を検出している。このため、サーボ領域間に記録されたデータ信号を再生する際のように、磁気ヘッドがトラック上を正確に走査したときのＳ／Ｎ比に優れることだけではなく、磁気ヘッドがトラックを外れて走査したときの再生出力変化量、すなわちオフトラック特性が急峻であることが要求される。従って、上記のようにプリフォーマット記録されたトラック端部の磁化遷移が急峻性に欠けると、今後のサブミクロントラック記録における正確なトラッキングサーボ技術の実現が困難になる。

【００１４】上記２つの問題点のうち前者を解決する技術として、例えば、磁気転写技術を用いたトラッキングサーボ信号等の複写技術が提案されている（特開昭６３－１８３６２３号公報参照）。このような磁気転写技術を用いれば、プリフォーマット記録の際の生産性が改善される。しかし、この技術は、フレキシブルディスクのように比較的保磁力が低く、面記録密度の小さい磁気ディスク媒体には有効であるが、今日のハードディスク媒体のように数百メガビットからギガビットオーダーの面記録密度を担う分解能を備えた高保磁力媒体に対しては使用することができない。磁気転写技術においては、転写効率を確保するために、被転写ディスクの保磁力の１．５倍程度の振幅を有する交流バイアス磁界を印加する必要がある。マスターディスクに記録されたマスター情報は磁化パターンであるので、この交流バイアス磁界によってマスター情報が消磁されないためには、マスターディスクの保磁力として、被転写ディスクの保磁力の３倍程度以上の値が要求される。現在の高密度ハードディスク媒体の保磁力は高面記録密度を担うために１５００～２５００エルステッドもある。さらに、将来の１０ギガビットオーダーの面記録密度を担うためには、この値は３０００～４０００エルステッドにも達するものと予想される。つまり、マスターディスクには、現状において４５００～７５００エルステッド、将来的には９０００～１２０００エルステッドの保磁力が要求されることになる。マスターディスクにおいてこのような保磁力を実現することは、磁性材料の選択の面から困難である。さらに、現状の磁気記録技術を用いては、このような高保磁力を有するマスターディスク自体にマスター情

報を記録することはできない。従って、従来の磁気転写技術においては、マスターディスクにおいて実現可能な保磁力値を考慮すると、必然的に被転写ディスクの保磁力に制約を受けることになる。

【００１５】また、例えば、特開平７－１５３０６０号公報には、トラッキング用サーボ信号、アドレス情報信号、再生クロック信号等に対応する凹凸形状を有するディスク媒体用基板をスタンパによって形成し、この基板上に磁性層を形成するというプリエンボストディスク技術が開示されている。この技術は、上記した２つの問題点に対して、ともに有効な解決策である。しかし、ディスク表面の凹凸形状が記録再生時のヘッド浮上特性（あるいは接触記録の場合には、媒体とのコンタクト状態）に影響を及ぼし、磁気ヘッドと磁気記録媒体との間のインターフェース性能に問題が生じることが予想される。また、スタンパで製造される基板は基本的にプラスチック基板であるため、媒体性能の確保のために必要な磁性層成膜時の基板加熱を行うことができず、必要な媒体Ｓ／Ｎ比が確保されないという問題点もある。

【００１６】以上のような技術的背景からは、上記した２つの問題点に関して、媒体Ｓ／Ｎ比やインターフェース性能など、他の重要性能を犠牲にすることのない、真に有効な解決策は見出されていない。

【００１７】以上の課題に対し、媒体Ｓ／Ｎ比やインターフェース性能など、他の重要性能を犠牲にすることなく、プリフォーマット記録を可能とする技術が、米国特許第３，８６９，７１１号に基本原理的に開示されている。また、これと類似する技術が、特開昭５７－２４０３２号公報、特開昭５７－１０９１３４号公報に開示されている。これらはいずれも、基体の表面に情報信号に対応する凹凸形状が形成され、この凹凸形状の少なくとも凸部表面が強磁性材料によって構成されたマスター情報担体の表面を、強磁性薄膜あるいは強磁性粉塗布層が形成されたシート状もしくはディスク状磁気記録媒体の表面に接触させるか、又は、さらに磁界を印加することにより、マスター情報担体の表面の凹凸形状に対応する磁化パターンを磁気記録媒体に記録するものである。

【００１８】

【発明が解決しようとする課題】上記したマスター情報担体の表面の凹凸形状の形成には、フォトリソグラフィー技術が用いられる。プリフォーマットされる磁気記録媒体がハードディスクの場合、マスター情報担体の大きさは少なくともハードディスクと同等以上であることが必要である。従って、マスター情報担体の基体の大面積にわたって精度良くフォトレジストパターンを形成する必要がある。この際、フォトレジストが厚い場合には、１μｍあるいはサブミクロンオーダーのパターンを高精度に形成することは非常に困難である。このため、１μｍ以下の薄いレジストパターンで微細加工を行う必要がある。

【００１９】本発明は、従来技術における前記課題を解決するためになされたものであり、将来の１０ギガビットオーダーの面記録密度に対応したプリフォーマット記録を実現することが可能なマスター情報担体を提供することを目的とする。

【００２０】

【課題を解決するための手段】前記目的を達成するため、本発明に係るマスター情報担体の第１の構成は、基体の表面に情報信号に対応する凹凸形状が形成され、前記凹凸形状の少なくとも凸部の表面に磁性薄膜が形成されたマスター情報担体であって、前記基体がシリコンもしくはシリコン酸化物からなり、前記凹凸形状が反応性イオンエッチング法もしくは反応性プラズマエッチング法を用いて加工されたことを特徴とする。このマスター情報担体の第１の構成によれば、１μｍ以下の薄いレジストパターンを用いて１μｍあるいはサブミクロンオーダーのパターンをマスター情報担体の基体の大面積にわたって高精度に形成することが可能となり、製造が容易な優れたマスター情報担体を安価に実現することができる。

【００２１】また、前記本発明のマスター情報担体の第１の構成においては、凹凸形状における凹凸の段差が磁性薄膜の膜厚よりも大きいのが好ましい。この好ましい例によれば、Ｓ／Ｎ比の高い信号記録が可能な優れたマスター情報担体を実現することができる。また、この場合には、凹凸の段差が磁性薄膜の膜厚の２倍以上であるのが好ましい。この好ましい例によれば、さらにＳ／Ｎ比の高い信号記録が可能な優れたマスター情報担体を実現することができる。

【００２２】また、前記本発明のマスター情報担体の第１の構成においては、シリコンもしくはシリコン酸化物と磁性薄膜との間に下地層が配置されているのが好ましい。この好ましい例によれば、信頼性の高い優れたマスター情報担体を実現することができる。また、この場合には、下地層の成分が凹凸形状の側壁に付着しているのが好ましい。この好ましい例によれば、下地層の成分が凹凸形状の表面を覆うこととなるので、帯電を防止することができ、静電気によるゴミの吸着を大幅に低減することのできる優れたマスター情報担体を実現することができる。また、この場合には、下地層が、Ｃｒ、Ａｌ及びＴｉからなる群から選ばれた１つの材料からなるのが好ましい。

【００２３】また、前記本発明のマスター情報担体の第１の構成においては、磁性薄膜が、基体近傍のガス圧が10^{-4}Ｔｏｒｒ以下に設定された状態で、真空蒸着法もしくはスパッタリング法を用いて形成されたものであるのが好ましい。この好ましい例によれば、高精度で製造が容易な優れたマスター情報担体を安価に実現することができる。

【００２４】また、本発明に係るマスター情報担体の第

２の構成は、基体の表面に情報信号に対応する凹凸形状が形成され、前記凹凸形状の少なくとも凸部の表面に磁性薄膜が形成されたマスター情報担体であって、前記基体が、高分子材料、半導体材料、金属材料及びセラミックス材料からなる群から選ばれた１つの材料からなる母材と、前記母材の上に形成されたシリコン層もしくはシリコン酸化物層とからなり、前記凹凸形状が反応性イオンエッチング法もしくは反応性プラズマエッチング法を用いて加工されたことを特徴とする。このマスター情報担体の第２の構成によれば、使用し易くかつ高精度な優れたマスター情報担体を実現することができる。

【００２５】また、前記本発明のマスター情報担体の第２の構成においては、母材とシリコン層もしくはシリコン酸化物層との間に中間層が配置されているのが好ましい。この好ましい例によれば、中間層の存在により、製造が容易でかつ高精度な優れたマスター情報担体を実現することができる。また、この場合には、中間層が、Ａｌ、Ｃｒ、Ｔｉ、Ｔａ、Ｍｏ、Ｗ及びAl_2O_3からなる群から選ばれた１つの材料からなるのが好ましい。

【００２６】また、前記本発明のマスター情報担体の第２の構成においては、凹凸形状における凹凸の段差が磁性薄膜の膜厚よりも大きいのが好ましい。また、この場合には、凹凸の段差が磁性薄膜の膜厚の２倍以上であるのが好ましい。

【００２７】また、前記本発明のマスター情報担体の第２の構成においては、シリコンもしくはシリコン酸化物と磁性薄膜との間に下地層が配置されているのが好ましい。また、この場合には、下地層の成分が凹凸形状の側壁に付着しているのが好ましい。また、この場合には、下地層が、Ｃｒ、Ａｌ及びＴｉからなる群から選ばれた１つの材料からなるのが好ましい。

【００２８】また、前記本発明のマスター情報担体の第２の構成においては、磁性薄膜が、基体近傍のガス圧が10^{-4}Ｔｏｒｒ以下に設定された状態で、真空蒸着法もしくはスパッタリング法を用いて形成されたものであるのが好ましい。

【００２９】

【発明の実施の形態】以下、実施の形態を用いて本発明をさらに具体的に説明する。まず、本発明のマスター情報担体を用いたプリフォーマット記録について、図１を参照しながら簡単に説明する。図１は本発明のマスター情報担体を用いた記録原理を説明するための概略図である。

【００３０】一方向に磁化されたマスター情報担体の表面の凸部の強磁性材料によって発生する記録磁界により、マスター情報担体の凹凸形状に対応した磁化パターンが磁気記録媒体に記録される。この様子を図１に示す。すなわち、マスター情報担体２の表面には、トラッキング用サーボ信号、アドレス情報信号、再生クロック信号等に対応する凹凸形状が形成されている。ここで、凹凸形状の凸部の表面は、強磁性材料によって構成されている。凸部表面の強磁性材料には励磁磁界４によって磁化３が誘起され、この誘起された磁化３によって磁気記録媒体１に転写磁界５が発生し磁気記録媒体１が磁化される。そして、これらに対応した残留磁化が磁気記録媒体１に残り、プリフォーマット記録される。

【００３１】〈第１の実施の形態〉以下に、本発明の第１の実施の形態におけるマスター情報担体について、図２を参照しながら説明する。図２は本発明の第１の実施の形態におけるマスター情報担体の構成を示す概略断面図である。

【００３２】図２に示すように、シリコン又はシリコン酸化物からなる基体６の表面には、マスター情報パターンに対応する凹凸形状が形成されている。凹凸形状の凸部７の表面には凸部磁性薄膜８が形成されており、凹部１４の表面には凹部磁性薄膜９が形成されている。

【００３３】基体６の表面の凹凸形状は、以下の工程によって形成される。まず、基体６の表面に、感光性レジストをスピンコータあるいはスプレーコータを用いて塗布する。感光性レジストの塗布厚は、１．０μｍ以下、さらには０．５μｍ以下であるのが好ましい。感光性レジストの塗布厚が厚すぎると、１．０μｍ以下の微細なパターニングを制御性良く行うことが困難となる。反応性エッチングの場合、高精度に実現される加工深さは、レジストの膜厚の０．５～１．０倍である。

【００３４】次いで、レジスト膜を露光・現像する。尚、必要に応じて、露光前にプリベーク等の前処理を行い、露光後にポストベーク等の後処理を行う。露光には、従来一般的に用いられている露光技術が用いられる。パターンピッチが数μｍのレベルであれば、プロジェクションによる一括露光が可能であり、パターンピッチが１．０μｍ程度であれば、収束したレーザー光で描画することが可能となる。さらに、パターンピッチがサブミクロンのオーダーである場合には、収束電子線描画法を用いて露光が行われる。現像には、パドル現像法やスプレー現像法が用いられる。現像終了後、洗浄処理を行い、必要に応じて紫外線照射処理を行う。

【００３５】次いで、レジストのパターニングが完了した基体６をエッチング装置によってエッチングする。エッチングには、反応性イオンエッチング法あるいは反応性プラズマエッチング法が用いられる。反応性イオンエッチングは、Ａｒ等の希ガスと共にCF_4等の反応性ガスをイオン化し加速して基板に飛来させ、シリコン（基体６）と反応性ガスを反応させることによって行われる。反応生成物は蒸気圧が高く、ガスとなって速やかに除去される。従って、レジストは反応せずに残留する。また、イオンは加速されており直進性が高いので、指向性の高いエッチングが可能である。一方、反応性プラズマエッチングは、Ａｒ等の希ガスとCF_4等の反応性ガスの混合ガスに高周波数の電磁界を印加することによっ

て行われ、これにより基体６の近傍に高密度のプラズマが生成される。このプラズマによって基体６にバイアス電位が誘起され、この電位によってプラズマ中のイオンが加速され基体６に到達する。イオンがシリコン基体６の表面に到達すると、上記反応性イオンエッチングの場合と同様に、シリコン（基体６）と反応性ガスとが反応し、反応生成物はガスとなって速やかに除去される。従って、この場合にも、レジストは反応せずに残留する。また、イオンは加速されており直進性が高いので、指向性の高いエッチングが可能である。

【００３６】次いで、エッチング完了後、レジスト剤に適合したリムーバ剤を用いて残留レジストを除去する。レジストの除去に際しては、必要に応じて、事前にプラズマアッシャーによってレジストの粗取りを行う。

【００３７】以上のようにして、シリコン基体６の表面に、マスター情報パターンに対応したシャープで寸法精度の良好な凹凸形状が形成される。さらにシャープで寸法精度の良好な凹凸形状を形成するためには、クロム薄膜をマスクとしてエッチングを行うのが好ましい。

【００３８】次いで、凹凸形状が形成された基体６の表面にクロム膜を成膜する。そして、クロム膜の表面にレジストを塗布した後、上記と同様にしてレジストパターンを形成する。レジストの膜厚は、クロム膜厚の２倍以上に設定される。レジストパターンを形成した後、イオンエッチングもしくはウエットエッチングを用いて、クロムパターンを形成する。クロムパターンを形成した後、必要に応じて、残留レジストを除去する。その後、上記と同様に、反応性イオンエッチングあるいは反応性プラズマエッチングを用いて、基体６の表面に凹凸形状を形成する。このとき、加工深さは、クロム膜マスクの膜厚の１０～２０倍まで許容される。

【００３９】次いで、基体６の凹凸形状を有する表面に磁性薄膜を形成する。磁性薄膜の材料としては、Ｎｉ－Ｆｅ、Ｆｅ－Ａｌ－Ｓｉ等の結晶材料、Ｃｏ－Ｚｒ－Ｎｂ等のＣｏ基のアモルファス材料、Ｆｅ－Ｔａ－Ｎ等のＦｅ系微結晶材料、Ｆｅ、Ｃｏ、Ｆｅ－Ｃｏ等が好ましい。磁性薄膜を形成するにあたっては、以下の点が重要である。

【００４０】磁性薄膜を形成するにあたって重要な点の１つは、凸部側壁への磁性体の付着の制御である。すなわち、凸部側壁に多量の磁性体が付着すると、凸部の寸法精度が低下し、凸部磁性薄膜８と凹部磁性薄膜９との磁気的結合が強化することとなるので、凸部側壁への磁性体の付着を制御しなければならない。この場合、凸部側壁への磁性体の付着は、凸部磁性薄膜８あるいは凹部磁性薄膜９の膜厚の１割以下に抑制する必要がある。

【００４１】上記のように凸部側壁への磁性体の付着を抑制することのできる磁性薄膜の形成方法としては、真空蒸着法、イオンビームスパッタ法あるいは対向ターゲットスパッタ法がある。いずれの方法も、膜を形成する際の基体表面近傍のガス圧を低く抑えることができる方法である。すなわち、基体表面に飛来する原子が途中でガスと衝突して散乱することのない、原子の平均自由行程の比較的長い成膜方法である。従って、このような条件が満足されれば、上記した３つの成膜方法以外の成膜方法も使用することができる。

【００４２】実験の結果、成膜中の基体近傍のガス圧が10^{-4}Ｔｏｒｒ以下であれば、凸部側壁への磁性体の付着を、凸部磁性薄膜８あるいは凹部磁性薄膜９の膜厚の１割以下に抑制することができることが分かった。

【００４３】磁性薄膜を形成するにあたって重要な点の他の１つは、凸部磁性薄膜８及び凹部磁性薄膜９の位置関係である。これは、基体６の表面に形成した凹凸形状の段差と磁性薄膜の膜厚に関係している。マスター情報担体において、凸部磁性薄膜８の好ましい膜厚は０．１μｍから０．５μｍの範囲とされている。凹凸形状の段差が磁性薄膜の膜厚よりも小さい場合には、凸部磁性薄膜８と凹部磁性薄膜９とが連続することになる。このような場合には、凸部磁性薄膜８と凹部磁性薄膜９との磁気的結合が強すぎて、マスター情報担体による磁気記録媒体への信号記録が不十分となる。従って、凹凸形状の段差は磁性薄膜の膜厚よりも大きいのが好ましい。さらには、凹凸形状の段差は磁性薄膜の膜厚の２倍以上であるのが好ましい。これは、凸部磁性薄膜８と凹部磁性薄膜９とが物理的に離れていても、その距離が小さければ磁気的結合が存在するからである。

【００４４】〈第２の実施の形態〉以下に、本発明の第２の実施の形態におけるマスター情報担体について、図３を参照しながら説明する。図３は本発明の第２の実施の形態におけるマスター情報担体の構成を示す概略断面図である。

【００４５】磁性薄膜を形成するにあたってさらに重要な点は、磁性薄膜８を形成する前に下地層１０を形成することである。下地層１０は、磁性薄膜８の付着強度を改善する働きをする。付着強度の改善は、マスター情報担体の信頼性及び耐久性の向上に大きく寄与することは言うまでもない。図２の構成よりも図３の構成の方がマスター情報担体の信頼性が高い。下地層１０の材料としては、シリコンあるいはシリコン酸化物との結合力が強く非磁性であるＣｒ、Ａｌ、Ｔｉ等の金属材料が好ましい。

【００４６】下地層１０は、その膜厚が０．０１μｍから０．０２μｍ程度で十分な機能を発揮する。このように薄い膜の形成においては、凸部側壁への膜付着量は無視できるほど小さいので、成膜法を磁性薄膜８のように厳しく吟味する必要はない。下地層１０の形成にあたっては、磁性薄膜８とは逆に、図４に示すように、積極的に凸部側壁に下地材料を付着させ、表面全体にわたって電気的導通を取るのが好ましい。これにより、帯電を防止することができ、静電気によるゴミの吸着を大幅に低

減することができる。このような下地層１０を形成するためには、10^{-3} Ｔｏｒｒ台で成膜可能な通常のスパッタ方法あるいは蒸着法を用いればよい。

【００４７】上記した一連の工程により、容易かつ安価に高精度なマスター情報担体を製造することができ、このようにして製造したマスター情報担体によれば、高いＳ／Ｎ比を有する信号記録が可能となる。

【００４８】〈第３の実施の形態〉以下に、本発明の第３の実施の形態におけるマスター情報担体について、図５を参照しながら説明する。図５は本発明の第３の実施の形態におけるマスター情報担体の製造工程の一例を示す概略断面図である。

【００４９】本実施の形態における基体は、その全体がシリコンあるいはシリコン酸化物からなるのではなく、基体母材部１１と基体表面部１２とにより構成されている。基体母材部１１としては、高分子材料、半導体材料、金属材料もしくはセラミックス材料等の非磁性材料が用いられる。図５（ａ）に示すように、この基体母材部１１の上には、基体表面部１２として、シリコンあるいはシリコン酸化物が形成されている。そして、図５（ｂ）に示すように、基体表面部１２のみが凹凸形状に加工されている。図５（ｂ）中、７が凸部である。このようにして基体を加工した後、上記のようにしてその表面に磁性薄膜を形成する。

【００５０】図６は本発明の第３の実施の形態におけるマスター情報担体の製造工程の他の一例を示す概略断面図である。図６に示すように、基体母材部１１と基体表面部１２との間には、主に付着力を改善し信頼性を高めるために、また、エッチング時の過エッチング防止を目的として、中間層１３が配置されている。中間層１３の材料としては、Ａｌ、Ｃｒ、Ｔｉ、Ｔａ、Ｍｏ、Ｗ、Al_2O_3 が好ましい。

【００５１】基体を基体母材部１１と基体表面部１２とにより構成する利点は、以下のとおりである。まず、基体の材料として、シリコンやシリコン酸化物に比べて安価な材料を用いることができる。例えば、汎用性が高く安価なアルミニウムやアルミニウム合金を用いることができる。しかも、凹凸形状の加工は、基体の材料としてシリコンやシリコン酸化物のみを用いた場合と同等のプロセスで同等の精度が確保される。

【００５２】次に、機械的強度と機械加工性を改善することができる。基体母材部１１の材料として高分子材料や金属材料を用いれば、マスター情報担体に、シリコンやシリコン酸化物のみでは得られない、強靭性を付与することができる。マスター情報担体を使用する際の、例えば、取り付け案内機構等の加工性も改善される。

【００５３】次に、凹凸形状の加工性が向上する。例えば、CF_4 を用いた反応性エッチングの場合、シリコンあるいはシリコン酸化物は高速にエッチングされるが、他の材料はエッチング速度が極端に遅い。すなわち、基体表面部１２の膜厚を管理しておけば、凹部の深さは基体表面部１２の膜厚となるので、深さ寸法の再現性が向上する。

【００５４】次に、マスター情報担体と磁気記録媒体との密着性が向上する。例えば、基体母材部１１の材料として高分子材料を用いれば、マスター情報担体に微小レベルの柔軟性が付与されるので、ハードディスク媒体との密着性が改善される。

【００５５】尚、上記実施の形態においては、基体の凸部と凹部の双方の表面に磁性薄膜が形成されているが、必ずしもこの構成のマスター情報担体に限定されるものではなく、凹凸形状の少なくとも凸部の表面に磁性薄膜が形成されていればよい。

【００５６】

【発明の効果】以上説明したように、本発明によれば、強靭性、柔軟性、塵芥除去性等を有しながら、１．０μｍ以下の微細パターンが精度良くかつ再現性良く形成されたマスター情報担体を実現することができる。

【図面の簡単な説明】

【図１】本発明のマスター情報担体を用いた記録原理を説明するための概略図である。

【図２】本発明の第１の実施の形態におけるマスター情報担体の構成を示す概略断面図である。

【図３】本発明の第２の実施の形態におけるマスター情報担体の構成を示す概略断面図である。

【図４】本発明の第２の実施の形態におけるマスター情報担体の値の構成を示す概略断面図である。

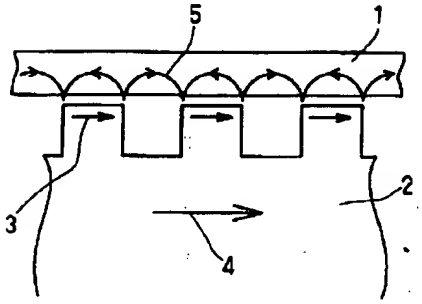
【図５】本発明の第３の実施の形態におけるマスター情報担体の製造工程の一例を示す概略断面図である。

【図６】本発明の第３の実施の形態におけるマスター情報担体の製造工程の他の一例を示す概略断面図である。

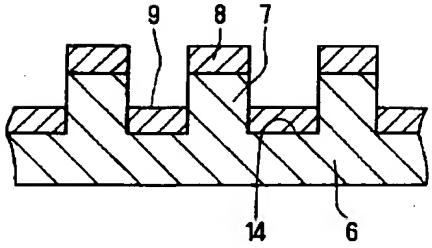
【符号の説明】

１　磁気記録媒体
２　マスター情報担体
３　励磁磁界により凸部磁性体に誘起された磁化
４　励磁磁界
５　転写磁界
６　基体
７　凸部
８　凸部磁性薄膜
９　凹部磁性薄膜
１０　下地層
１１　基体母材部
１２　基体表面部
１３　中間層

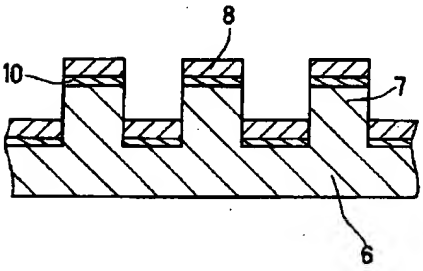
【図１】



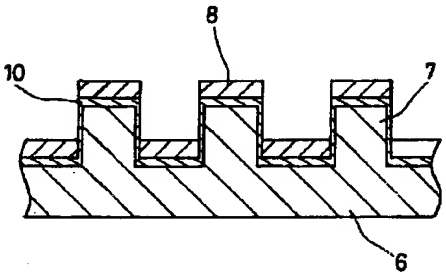
【図２】



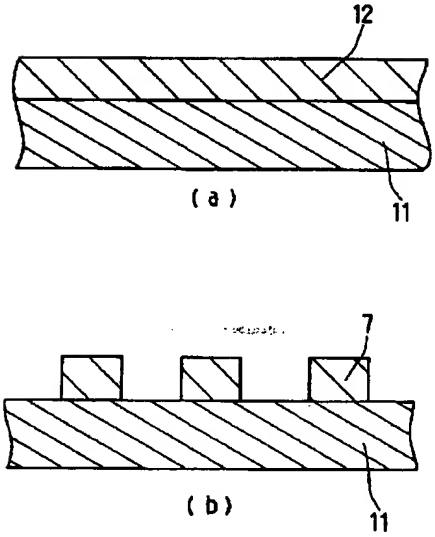
【図３】



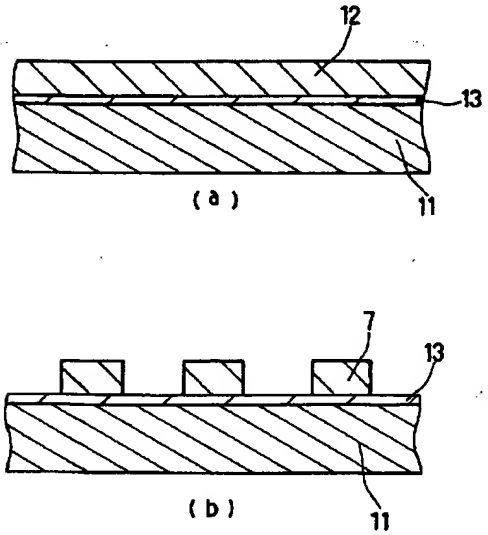
【図４】



【図５】



【図６】



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